LABELER BELLOWS WITH IMPROVED SERVICE LIFE

FIELD OF THE INVENTION

[0001] This invention relates to a labeling apparatus and more particularly, to a labeling apparatus for the application of labels to fruit and/or vegetables.

BACKGROUND OF THE INVENTION

[0002] Labels are applied to fruit and vegetables in packing houses, where the speed at which the labels are applied and the accuracy of the label application are important considerations. Speed is important because the fruit must be packed and shipped quickly so that the shelf life in stores will be as long as possible and the speed of the labeler may be a limiting constraint. The constraint of labeler speed may also result in inefficient use of other equipment and personnel in the packing house, thus increasing the overall cost of operation. Accuracy, in the form of the successful application of the proper label to the fruit, is important because packing house profitability is adversely affected when a label that would have permitted a higher selling price is not applied to fruit otherwise capable of commanding such a higher price.

[0003] One known type of labeler used to label fruit and vegetable includes an extendable bellows for placing the labels (see, e.g., U. S. Patent No. 4,547,252 and EP 0113256). With this type of labeler, the bellows is moved past a magazine or cassette which dispenses the labels from a carrier strip. The labels are held in position on the end of the bellows by application of a vacuum to the bellows that is pulled through openings in the end of the bellows. The vacuum also serves to maintain the bellows in a retracted position. As the bellows is moved to an application position adjacent a fruit, positive pressure is applied and the bellows is extended to contact the fruit and apply the label thereto.

[0004] The repeated extension and retraction of the bellows during the labeling process subjects the bellows to stresses and strains that adversely affect the service life of the

bellows. These stresses and strains are exacerbated in a rotary bellows arrangement, which includes a plurality of expandable bellows mounted on a rotatable carrier. In particular, because the bellows are rotating at the same time that they are extending, a relatively larger stress is applied to the leading edge of the bellows body. As a result, the leading edge of the bellows body eventually can fail, such as by a crack or tear, leading to decreased labeler performance or even a fault mode due to loss of vacuum pressure in the bellows.

BRIEF SUMMARY OF THE INVENTION

[0005] A labeler for applying labels to articles is provided. The labeler includes a label application device having an opening in an end thereof. The label application device being expandable when subjected to pressure. The label application device including a first component defining a working face of the label application device on which labels are carried and a second component defining a body of the label application device to which the first component is secured. The first component being constructed of a first material to which the label adhesive will not readily adhere and the second component being constructed of a second material that is relatively more fatigue resistant than the first material.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] FIG. 1 is a side elevation view of an illustrative labeler according to the present invention with a labeling cassette installed.

[0007] FIG. 2 is a cross-sectional view taken along the line 2-2 of FIG. 1.

[0008] FIG. 3 is a partially cut away top plan view of the labeler of FIG. 1 with the labeling cassette removed.

[0009] FIG. 4 is a top plan view of a portion of the labeler of FIG. 1 showing the bellows wheel.

[0010] FIG. 5 is a side elevation view of the label cassette for the labeler of FIG. 1.

[0011] FIG. 6 is a top plan view of the label cassette of FIG. 5.

[0012] FIG. 7 is a side sectional view of one of the bellows showing the flow control element.

[0013] FIG. 8 is a side sectional view of the flow control element of FIG. 7 showing the air flow paths through the flow control element.

[0014] FIG. 9 is a side elevation view of the flow control element of FIG. 7.

[0015] FIG. 10 is a bottom plan view of the flow control element of FIG. 7.

[0016] FIG. 11 is a side elevation view of the flow control element of FIG. 7 with the cap portion removed.

[0017] FIG. 12 is a side elevation view of the cap portion of the flow control element of FIG. 7.

[0018] FIG. 13 is a side sectional view of an alternative embodiment of an exemplary bellows having a two-piece construction.

DETAILED DESCRIPTION OF THE INVENTION

[0019] Referring now to FIG. 1, there is shown an illustrative labeler 10 for applying labels to articles such as fruit or vegetables constructed in accordance with the teachings of the present invention. The illustrated labeler 10 includes a labeler base 12 and a label cassette 14 in engagement therewith and supported over a conveyor 16 having conventional cradles for holding and positioning individual fruit 18 or any other article to be labeled. The label cassette 14 is releasably retained on the labeler base 12 and the cassettes are interchangeable so that one cassette can be loaded off-line with a reel of a carrier bearing labels while another cassette is operatively engaged with the labeler base 12 to apply labels to the fruit.

[0020] In the illustrated embodiment, the labeler 10 includes a rotatable bellows wheel 20 that supports a plurality of expandable bellows 22 which serve, in this case, as label application devices. Each bellows is movable between extended and retracted positions responsive to positive and negative internal fluid pressure, respectively applied through, in this instance, an open end thereof. Each bellows 22 includes an end wall 24 having, at least

one, but in this case multiple openings 26 therein (see, e.g., FIG. 7). Drawing negative fluid pressure or vacuum through the openings 26 in the end of the bellows 22 holds a label in position on the end of the individual bellows 22. This negative pressure or vacuum also serves to retract the bellows 22. When expanded, the individual bellows 22 extends towards the piece of fruit 14 to effect the application of a label thereto as described in greater detail below. Each bellows 22 also includes a pleated sidewall 28 connected to the end wall 24. The pleated sidewall 28 permits the bellows 22 to move between the extended and retracted positions responsive to internal fluid pressure.

[0021] Additional details regarding the illustrated labeler are provided in U.S. Patent Application Serial Nos. 09/187,441 and 09/453,757 the disclosure of which is incorporated herein by reference. While the present invention is described in connection with a rotary bellows type labeler, those skilled in the art will appreciate from the following description that the invention is equally applicable to any type of labeler having a label application device that uses a vacuum for picking up a label and pressure to effect the deposit of a label on an article. For example, instead of a bellows, the label application device could comprise a piston, an expandable balloon-type mechanism or any other mechanism which is expandable when subject to pressure.

[0022] For retracting the individual bellows 22, the labeler 10 is connected to a vacuum tube 30 (see FIG. 2) that is in turn connected to a vacuum source in a known manner. Additionally, for effecting extension of the bellows, a pressure tube 32 is provided which in this case extends along the interior of the vacuum tube 30. The pressure tube 32 is connected to a source of air pressure, which may be a conventional blower. As best shown in FIGS. 3 and 4, the bellows wheel 20 has a tubular portion 34 which is rotatable on and sealingly engageable on its ends with the vacuum tube 30. In this case, eight cylindrical projections 36 are provided around the periphery of the tubular member 34.

[0023] A flexible bellows is provided for each of the projections 36. Each of the bellows 22 is retained by an outward projecting flange 38 on a relatively rigid cup 40 having a slotted end for insertion into a cylindrical projection 36 as shown in FIG. 7. A lip

formed on the slotted end snaps into an internal groove in the projection 36 to releaseably retain the cup 40 in place. Holes in the outer end of the cup 40 communicate pressure or vacuum in the projection 36 to the associated bellows 22. The cup 40 can also function to limit the amount of collapse for the associated bellows when subjected to vacuum.

[0024] For controlling the extension and retraction of each of the flexible bellows 22 so as to allow application of a label to an article, the illustrated labeler 10 is configured to selectively connect each of the bellows 22 to the vacuum and pressure sources such that each of the individual bellows is subjected to pressure when adjacent a label application position and subjected to vacuum for picking up a label at a label pick-up position. To this end, each of the cylindrical projections 36 is provided with a slot 42 to permit communication with the tube 30 via a plurality of equally spaced radial holes 44 as shown in FIGS. 3 and 4. A cross tube 46 is connected, and communicates air pressure, between the pressure tube 32 and a slot 48 in the vacuum tube 30 at the six o'clock position.

[0025] The width of the slots 42 in the projections is wider than the space between the holes 44 so that vacuum is always available to each projection 36, except when the projection is at the six o'clock position. As the slot 42 for each projection 36 rotationally approaches that position, vacuum access is interrupted and communication with the pressure slot 48 is initiated. Similarly, as each projection rotationally leaves the 6 o'clock position, pressure is cut-off just before access to vacuum is permitted. Thus, the bellows 22 are contracted throughout the rotation of the tubular member 34 except when in proximity to the six o'clock position. It is in that position that each of the bellows 22 is extended toward the fruit to effect the application of a label thereto. Of course, other arrangements for controlling the extension and retraction of the bellows could be employed.

[0026] For feeding labels to the individual bellows 22, the label cassette 14 includes a label feed mechanism. A drive mechanism 56 is also provided which, in this case, is operable to advance the label feed mechanism. The illustrated label feed mechanism includes a cassette sprocket 50 carried on a shaft 52 supported by a cassette frame 53 and a hub 54 which is also affixed to the shaft 52 as shown in FIGS. 5 and 6. The cassette

sprocket 50 is linked via gearing to the drive mechanism 56, which in the illustrated embodiment includes a numerically controlled motor, such as a stepper motor, contained in the labeler base 12 (see FIG. 3). The label cassette 14 further includes a label carrier strip 58 having a plurality of labels carried thereon is wound on a reel 60 which is rotatably supported on handles 62 as shown in FIGS. 1 and 5. The label carrier strip 58 from the reel 60 is drawn around the hub 54 such that when operation of the drive mechanism though the sprocket 50 causes the hub 54 to rotate, the carrier strip 58 is unwound from the reel 60. In this instance, the hub 54 has a depressed center section with sinusoidal side walls 64 (see, e.g. FIG. 6). The sinusoidal side walls 54 engage complementarily shaped edges of a label carrier strip 58 in order to facilitate accurate positioning and advancement of the carrier strip.

[0027] After being drawn around the hub 54, the label feed mechanism advances the carrier strip 58 along a separation plate 66 (see FIG. 6) which separates the labels from the carrier strip. The illustrated separation plate is particular designed for a carrier strip 58 that includes a line of weakness down its middle forming separate halves. The labels are attached over both halves of the carrier strip. To separate the labels from the carrier strip, the separation includes a V-shaped notch 68 with each half of the carrier strip 58 being drawn over a different side of the V-shaped notch. This causes the two halves of the carrier strip 58 to follow divergent paths from each other, and also from the label thereby forcibly releasing the label from the label strip for pick-up by one of the bellows 22. Each half of the separated carrier is then drawn back from the V-shaped notch 68 and wound around a respective take-up wheel 70. It will be appreciated by those skilled in the art that the present invention is not limited to the particular label feed and separation mechanism shown or to label strips having sinusoidal shaped edges.

[0028] To rotate the bellows wheel 20, the drive assembly 56 is linked to a gear 72 (see FIG. 3) on the bellows wheel. In the illustrated embodiment, the drive assembly is activated by a fruit sensing switch 74 that is positioned besides the conveyor 16 to detect the approach of a piece of fruit in a cradle on the conveyor as shown in FIG. 1. The drive

assembly could also be activated by the conveyor mechanism such as when an electronic produce sizer or grader device is provided. Upon activation, the drive assembly advances the label feed mechanism to feed a label to the bellows wheel 20 and the bellows wheel 20 to effect the depositing of a label retained on an individual bellows 22 on an article positioned at a label application position.

[0029] To ensure that the label is not prematurely blown off of the end of the bellows 22 as the bellows 22 is extended, each bellows 22 includes a flow control element 76 which delays the application of pressure to the end of the bellows when the bellows is extended. To this end, the flow control element 76 is arranged adjacent the openings 26 in the end wall 24 of the bellows 22 (see FIG. 7) so as to effectively separate the openings 26 from the remainder of the bellows and the open thereof through which the vacuum and pressure are applied. The flow control element 76 further includes at least one air flow or flow control passage and, in the illustrated embodiment, a plurality of air flow passages that allow fluid communication between the end openings 26 and the open end of the bellows. Thus, when pressure is applied through the open end of the bellows, the air flow must pass through one or more air flow paths through the flow control element that are defined by the air flow passages to reach the end openings in the bellows.

[0030] The air flow passages allow air flow through the flow control element 76 whether positive or negative pressure is being applied to the bellows 22. However, the air flow passages are configured such that the one or more air flow paths to the end openings 26 are sufficiently long, narrow and/or tortuous such that when pressure is applied to the bellows 22 through the open end thereof there is a delay in the air flow reaching the end chamber. This delay prevents the label from being blown off the end of the bellows 22 as the bellows 22 is being extended. It will be appreciated that this delay can be accomplished with a single air flow passage defining a single air flow path through the flow control element, with multiple interconnected air flow passages defining a single path through the flow control element or with multiple air flow passages defining multiple paths through the flow control element as in the illustrated embodiment.

[0031] To ensure that air flow does not bypass the air flow passages, the illustrated flow control element 76 divides the bellows so as define an end chamber 78 that communicates with the openings 26 in the end wall 24 of the bellows 22. Thus, in this case, the flow control element is configured to engage the side wall 28 of the bellows 22 near the end wall 24 thereof so as to inhibit the flow of air around the perimeter of the flow control element 76. The illustrated flow control element 76 includes a thin disk shaped portion 84 and a cone shaped portion 86 extending outward from, in this case, the center of one side of the disk shaped portion 84. When installed in the bellows 22, the disk portion 84 extends into engagement with the side wall 28 of the bellows 22 while the cone portion 86 extends inward towards the open end of the bellows as shown in FIG. 7. In particular, the flow control element 76 can be arranged in the bellows 22 such that the circumferential edges of the disk portion 84 of the element extend into and engage the first pleat of the side wall 28 of the bellows near the end wall 24 of the bellows. In the illustrated embodiment, the disk portion further includes an annular ring 88 that protrudes from the side of the disk portion 84 opposite the cone portion 86 to provide the disk member 84 with additional structural rigidity.

[0032] The cone portion 86 of the flow control element 76 provides a thicker or enlarged section of the element within which the air flow passages can be provided. In particular, the enlarged size of the cone portion 86 allows the air flow passages to be of sufficient length so as to provide the desired delay in the flow of air to the openings 26 in the end wall 24 of the bellows 22. The use of a configuration featuring a relatively thinner portion that engages the side wall 28 of the bellows 22 and a relatively thicker portion for housing the air passages also ensures that the flow control element 76 is relatively lightweight and requires a minimal amount of space. However, while the illustrated configuration can provide certain advantages, those skilled in the art will appreciate that the flow control element can have any suitable configuration which separates the end openings 26 from the remainder of the bellows such that air flow to and from the end openings 26 caused by the application of pressure and vacuum to the bellows passes through the one or

more air flow passages in the flow control element. For example, the flow control element 76 could be attached directly to the inside face of the end wall 24 of the bellows 22 or molded into the end wall 24 itself.

[0033] To ensure that there is a suitable delay in the flow of air through the flow control element 76, the air flow passages in the illustrated embodiment are interconnected so as to provide multiple continuous air flow paths through the flow control element. The air flow passages include passages which extend through the cone portion 86 as well as passages defined by recesses or grooves in the surface of the cone portion 86 and a cap 90 which is arranged over the cone portion. In particular, two longitudinally extending grooves 92 (one of which is shown in FIG. 11) are provided on the outer surface of the cone portion 86. These longitudinal grooves 92 intersect a circumferential groove 94 that is provided in the outer surface of the cone portion 86 near the end thereof as shown in FIG. 11. When the cap portion 90 is assembled over the cone portion 86, the gaps between the cap 90 and the outer surface of the cone portion 86 created by the longitudinal grooves 92 define longitudinally extending air flow passages 96 in the cone portion 86 as best shown in FIG. 8. Likewise, the gap created by the circumferential groove 94 defines a circumferential air flow passage 98 in the cone portion 86. The cap 90 can be secured to the cone portion 86 using any suitable method such as for example glue or sonic welding. The use of a cap is of course optional, and when used, the cap can have any configuration that allows air flow passages to be defined by grooves in the surface of the flow control element and the inside surface of the cap.

[0034] As shown in FIG. 10, the air flow passages in the cone portion 86 of the illustrated air flow control element 76 further include a pair intersecting radial air flow passages 100 each of which communicates at either end with the circumferential air flow passage 98. In this instance, one of the radial passages 100 further communicates with a pair of interior air flow passages 102 which extend through the cone portion to the opposite side of the element. As shown in FIGS. 8, 9 and 11, the interior air flow passages 102 are angled such that each passage extends parallel to the exterior surface of the cone portion 86.

In the illustrated embodiment, the flow passages are arranged symmetrically with respect to the cone portion 86 to ensure that the forces applied to the flow control element 76 are properly balanced.

[0035] FIG. 8 illustrates the flow of air through these passages when pressure is applied to extend the bellows 22. As shown, the air flows underneath the cap 90 along the longitudinal air passages 96 to the circumferential passages 98. The air then flows through the intersecting radial passages 100 and from there through the interior passages 102 to the chamber 78 at the end of the bellows 22. Thus, the illustrated network of air flow passages provide continuous but relatively narrow and tortuous paths for air to travel to and from the end chamber 78. Accordingly, when pressure is applied to extend the bellows 22, there will be a delay before that pressure reaches the end chamber 78 and causes air flow out of the openings 26 in the end of the bellows 22. This delay is long enough to ensure that the label is held on the end of the expanding bellows until it is applied to an article. Of course, the flow control element 76 produces a similar delay in air flow when the bellows 22 is subjected to a vacuum. Thus, the bellows 22 should be connected to the vacuum source sufficient time in advance of reaching the label pick-up position to ensure that a vacuum is being drawn through the openings 26 in the end wall 24 of the bellows 22 when a new label is picked-up.

[0036] To ensure proper relative positioning of the flow control element 76 and the end wall 24 of the bellows 22 as the bellows moves between the extended and retracted positions, a projection 104 can be provided on the side of the flow control element 76 facing the end wall of the bellows. As shown in FIG. 7, this projection 104 defines a first stop surface which is engageable with a second stop surface defined by a mating projection 106 on the inside surface of the end wall 24 of the bellows 22. These mating projections 104, 106 ensure that the end wall 24 of the bellows 22 remains spaced from the flow control element 76 even when the bellows is retracted.

[0037] To help extend its useful service life, the bellows 22 can have a construction in which the majority of the bellows body is made of a relatively more fatigue resistant

material than is presently used in conventional bellows while the working face is made of a different material which is capable of releasing the adhesive labels onto the objects to be labeled and to which the label adhesive does not adhere. Conventional bellows are molded entirely from a silicon material. Unfortunately, silicon has a relatively low tear strength, leading to a short service life in an application such as a labeler involving repeated, rapid expansion and contraction. As a result, time-consuming and costly shut downs of the labeler equipment are frequently necessary in order to replace the bellows.

[0038] As shown in FIG. 13, the bellows 22 can have a two-piece or component construction that allows the bellows body and the working face to be constructed of different materials. In particular, the bellows body, which is the portion of the bellows subject to the greatest stresses during expansion and retraction and, if applicable, rotation, can be made of a relatively tougher more tear resistant material that will be more resistant to wear or, in other words, have a longer service life. The working face of the bellows, which is the portion of the bellows that carries the labels, can, in turn, be made of a material to which the adhesive from the labels will not adhere. The two component structure also could allow the bellows body to be a disposable element with the working face being reusable. In the illustrated embodiment, the pleated sidewall 28 portion of the bellows comprises one of the components and the end wall 24 of the bellows comprises the other component. Referring to FIG. 13, the outer circumferential edge of the end wall 24 of the bellows 22 extends into engagement with the inside of the sidewall 28 of the bellows and, in particular, into engagement with the first pleat of the sidewall 28 nearest the end of the bellows.

[0039] The end wall 24 can be secured in position relative to the sidewall 28 of the bellows 22 using any suitable method or system such as an adhesive, welding, melting or mechanical fasteners such as staples. Alternatively, the end wall 24 could be captured by the bellows sidewall 28 in such a manner that adhesives or mechanical fasteners are not necessary. For example, the end wall 24 piece could be provided with a skirt configured as a pleat within which the flow control element 76 can be captured. The end wall 24 component and flow control element 76 assembly then could be captured in the sidewall 28

component of the bellows 22. Moreover, as opposed to using a two-piece or component construction, the bellows could be an integral body in which the working face portion is constructed of the adhesive resistant material and the bellows body is constructed of the more fatigue resistant or longer service life material.

[0040] As will be appreciated, while in the illustrated embodiment the two pieces generally comprise the sidewall 28 portion of the bellows 22 and the end wall 24 portion of the bellows, other configurations are also possible. For example, it is only necessary that the working face of the bellows 22 (i.e., the portion of the end wall 24 that will carry the labels) be constructed of a material to which the label adhesive will not adhere. Thus, the entire end wall 24 does not need to be constructed of the adhesive resistant material. Moreover, while it is generally desirable to construct all of the portions of the bellows 22 that will be subject to movement during the expansion and retraction of the bellows of the longer service life or more fatique resistant material, it is possible that the sidewall 28 portion of the bellows 22 would not be made entirely of the longer service life material.

[0041] One example of a material suitable for use with the working face, or the end wall 24 in the illustrated embodiment, of the bellows 22 is silicon. Of course, other adhesive resistant materials could also be used such as for example a teflon impregnated material. An example of a material suitable for use with the body, or in the illustrated embodiment the sidewall 28 of the bellows 22, is black natural rubber. Other extended service life materials also could be used such as for example neoprene. One advantage of the two-piece bellows construction of the embodiment illustrated in FIG. 13 is that a material that may not be resistant to adhesive build-up can be used with the bellows body since that portion of the bellows does not regularly come into contact with the labels being applied.

[0042] All references, including publications, patent applications, and patents, cited herein are hereby incorporated by reference to the same extent as if each reference were individually and specifically indicated to be incorporated by reference and were set forth in its entirety herein.

[0043] The use of the terms "a" and "an" and "the" and similar referents in the context of describing the invention (especially in the context of the following claims) are to be construed to cover both the singular and the plural, unless otherwise indicated herein or clearly contradicted by context. Recitation of ranges of values herein are merely intended to serve as a shorthand method of referring individually to each separate value falling within the range, unless otherwise indicated herein, and each separate value is incorporated into the specification as if it were individually recited herein. All methods described herein can be performed in any suitable order unless otherwise indicated herein or otherwise clearly contradicted by context. The use of any and all examples, or exemplary language (e.g., "such as") provided herein, is intended merely to better illuminate the invention and does not pose a limitation on the scope of the invention unless otherwise claimed. No language in the specification should be construed as indicating any non-claimed element as essential to the practice of the invention.

[0044] Preferred embodiments of this invention are described herein, including the best mode known to the inventors for carrying out the invention. Of course, variations of those preferred embodiments will become apparent to those of ordinary skill in the art upon reading the foregoing description. The inventors expect skilled artisans to employ such variations as appropriate, and the inventors intend for the invention to be practiced otherwise than as specifically described herein. Accordingly, this invention includes all modifications and equivalents of the subject matter recited in the claims appended hereto as permitted by applicable law. Moreover, any combination of the above-described elements in all possible variations thereof is encompassed by the invention unless otherwise indicated herein or otherwise clearly contradicted by context.